Mixed convection boundary layer flow over a moving vertical flat plate in an external fluid flow with viscous dissipation effect

ABSTRACT

The steady boundary layer flow of a viscous and incompressible fluid over a moving vertical flat plate in an external moving fluid with viscous dissipation is theoretically investigated. Using appropriate similarity variables, the governing system of partial differential equations is transformed into a system of ordinary (similarity) differential equations, which is then solved numerically using a Maple software. Results for the skin friction or shear stress coefficient, local Nusselt number, velocity and temperature profiles are presented for different values of the governing parameters. It is found that the set of the similarity equations has unique solutions, dual solutions or no solutions, depending on the values of the mixed convection parameter, the velocity ratio parameter and the Eckert number. The Eckert number significantly affects the surface shear stress as well as the heat transfer rate at the surface.

Keyword: Mixed convection; Boundary layer; Moving plate.